

Facilitating the Capture & Access of Everyday Activities

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ABSTRACT

There are situations in life when people need to recall specific details from previous experiences. To complement what can naturally be remembered, people will use tools to help create artifacts that preserve information pertaining to an experience. Unfortunately, the act of generating these records can sometimes conflict with people's abilities to fully appreciate the experiences. To assist in this process, many automated capture and access applications have been developed to relieve us from the burden of manually documenting these experiences. In this research, we develop an infrastructure to facilitate the construction of this class of applications for a variety of situations and domains.

Keywords

Ubiquitous computing, capture and access application, infrastructure, application development.

INTRODUCTION

Ubiquitous computing is a vision of technology seamlessly integrated into the environment to assist humans in their everyday lives [7]. One of the services envisioned is the automated capture of everyday experiences made available for future access. Automated capture and access applications leverage what computers do best – record information. In return, humans are free to fully engage in the activity and to synthesize the experience, without having to worry about tediously exerting effort to preserve specific details for later perusal.

As ubiquitous computing becomes more and more pervasive, it is important to understand instances where capture and access services are desirable and when it is inappropriate. One way of learning how people can benefit and use automated capture and access services is by actually evaluating its authentic use in these environments. Over the years, researchers have constructed capture and access applications for classrooms [1], [4] and meeting rooms [3], [5]. However, there still exist many more domains that could potentially benefit from the same kinds of services, such as the home and the car.

To facilitate research in ubiquitous computing, advances are necessary to improve the tools available for those with creative applications to realize their visions. Toolkits and infrastructures can provide levels of abstractions as well as reusable building block that can aide in the development

process of a system. In this research, we have developed INCA (an infrastructure for capture and access applications) aimed:

1. to lower the barrier for building capture and access applications,
2. to make complex applications more evolvable, or capable of being fine tuned to meet the users' true needs, and
3. to support the construction of a wider variety of applications previously unexplored.

CAPTURE AND ACCESS REQUIREMENTS AND ISSUES

In his 1945 Atlantic Monthly article, Vannevar Bush described his vision of the *memex*, a generalized capture and access application [2]. He noted that a "record ... must be continuously extended, it must be stored, and above all it must be consulted." The point of every capture and access application is to preserve some portion of an experience so that it can be *accessed* in the future. While the specifics of why users want capture and access services are domain dependent, from the users' perspective, all capture and access applications need to support:

- the preservation of details from an experience,
- the marking of associations between these captured artifacts, and
- the availability of all information on a topic from previous experiences when needed.

To meet these broad goals, application developers need to provide support:

- for ensuring that information is captured,
- for associating and aggregating related information,
- for keeping information available for later use, and
- for providing information when users want it.

AN INFRASTRUCTURE FOR CAPTURE & ACCESS

Capture and access applications are typically comprised of a confederation of heterogeneous components that must work seamlessly together. As a result, application developers are often forced to exert large amounts of effort and time at tediously creating the "glue" that allows these independent, distributed, and heterogeneous systems to work together. However, these are *accidental* tasks – tasks

not directly related to the developer's primary goals in the development of the application. This points out the potential for lower level support to aid in the construction of capture and access applications.

Many capture and access applications have been built as one-off prototype demonstration vehicles, not meant to be extensible over time. However, the architectural similarities that exist across these applications point to the potential creation of reusable components to reduce future development time and effort. An examination of this class of applications reveals similarities in functionality, where some part of the system is responsible for:

- the *capture* of information,
- the *storage* of the information,
- the *transduction* of information into different formats,
- the *access* of the information, and
- the *integration* and *synchronization* of related information when multiple streams of information are captured.

We have developed an infrastructure to leverage on these natural separation of concerns common across capture and access applications, while abstracting away some of the complexities that arise in the development of this class of applications, such as:

- **Networking:** providing developers with a single, repeatable design process for building both networked or stand-alone applications in the same fashion.
- **Information management:** generically capturing, storing, and delivering all information streams as raw bytes tagged with contextual metadata attributes.

Additional features include support for observing the capture and access system's run-time state as well as the ability to control capture and access allowing end-users and application developers to address privacy concerns. Through these separations of concerns, key architectural abstractions, a toolkit of reusable services, and other additional features, this infrastructure addresses the *accidental* tasks in the development process of the applications themselves. As a result, developers can then focus on solely building applications to meet the users' needs.

RESEARCH HYPOTHESES

As part of this research, we will use the infrastructure to evaluate the following hypotheses:

- The infrastructure will allow application developers to more easily build and evolve capture and access applications.
- Designers can build solutions that are reusable by other application developers.

- INCA can support the development of a wider variety of applications previously unexplored.

SUMMARY AND FUTURE RESEARCH

Our research is aimed at providing application developers with an infrastructure that makes it easier to build capture and access systems. We have completed the first version of the capture and access infrastructure and have made this distribution publicly available. We have provided the infrastructure to members of our research group as well as several other research institutes. We will investigate the infrastructure's ease-of-adoption by programmers. Feedback from the developers will be elicited to understand the kinds of applications that they are actually able to build and the difficulties they encounter.

Additionally, we have done an extensive study of related work, and have described a set of dimensions for capture and access applications [6]. Using the results from this study we are able to identify the design space for capture and access applications and the holes in this design space. We will re-implement several applications from the literature to demonstrate INCA's support for aiding in the construction of existing applications. We will demonstrate INCA's support for building a wide range of applications by varying the extremes for all dimensions of the design space; thereby proving its potential support for all possible applications.

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